Application Serial No.: 09/931,257
Reply to Office Action dated August 26, 2003

IN THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A semiconductor laser device comprising:

a semiconductor laser element;

a temperature measuring element ~~configured~~ to measure a temperature of said semiconductor laser element;

a temperature regulating unit ~~having~~ thermally connected to said semiconductor laser element and said temperature measuring element ~~thermally connected thereto~~;

a current detecting unit ~~configured~~ to detect a driving current applied to said semiconductor laser element; and

a control unit ~~configured~~ to control said temperature regulating unit ~~using~~ by a control function to achieve a substantially constant wavelength output from said semiconductor laser element, said control function defining a relationship between a predetermined driving current and a predetermined temperature, said control unit being ~~configured~~ electrically connected to said temperature measuring element, said temperature regulating unit, and said current detecting unit to control said temperature regulating unit such that the temperature detected by said temperature measuring element substantially equals the predetermined temperature corresponding to the detected driving current as defined by said control function,

wherein said semiconductor laser element includes a diffraction grating ~~and is configured~~ to oscillate plural longitudinal modes.

2. (Original) The semiconductor laser device according to Claim 1, wherein said control unit is configured to control said temperature regulating unit to extract heat from said

semiconductor laser element as the detected driving current increases in accordance with said control function.

3. (Canceled)

4. (Canceled)

5. (Original) The semiconductor laser device according to Claim 1, wherein:

said semiconductor laser element includes an active layer; and

said control function is defined such that a temperature of said active layer remains substantially constant for varying driving currents.

6. (Original) The semiconductor laser device according to Claim 1, wherein said control unit includes a storage unit configured to store said control function.

7. (Original) The semiconductor laser device according to Claim 1, wherein:

said control unit further comprises a setting unit which sets a desired wavelength, and a storage unit configured to store plural control functions;

said control unit is configured to select a new control function from said plural control functions that corresponds to a desired wavelength entered into said setting unit; and

said control unit is configured to control said temperature regulating unit according to said new control function.

8. (Original) The semiconductor laser device according to Claim 1, wherein said control function is common to semiconductor laser devices having similar structure and operation.

9. (Original) The semiconductor laser device according to Claim 1, wherein said control function is defined by plural temperatures detected by said temperature measuring element and corresponding driving currents detected by said current detecting unit where a

substantially constant wavelength output from said semiconductor laser element is maintained.

10. (Original) The semiconductor laser device according to Claim 1, wherein said control function is a linear function of predetermined temperature versus predetermined driving current.

11. (Original) The semiconductor laser device according to Claim 1, wherein said control function is a quadratic function of predetermined temperature versus predetermined driving current.

12. (Original) The semiconductor laser device according to Claim 1, wherein said temperature regulating unit is a Peltier device and said temperature measuring device is a thermistor.

13. (Currently Amended) A semiconductor laser device comprising:

a semiconductor laser element;

a temperature measuring element ~~configured~~ to measure a temperature of said semiconductor laser element;

a temperature regulating unit ~~having~~ thermally connected to said semiconductor element and said temperature measuring element ~~thermally connected thereto~~;

a means for detecting a driving current applied to said semiconductor laser element; and

a means for controlling said temperature regulating unit using a control function to achieve a substantially constant wavelength output from said semiconductor laser element, such that the temperature detected by said temperature measuring element substantially equals the predetermined temperature corresponding to the detected driving current as

defined by said control function,

wherein said means for controlling is electrically connected to said temperature measuring element, said temperature regulating unit, and said means for detecting, and

wherein said semiconductor laser element includes a diffraction grating ~~and is configured~~ to oscillate plural longitudinal modes.

14. (Original) The semiconductor laser device according to Claim 13, wherein:

said control function defines a relationship between a predetermined driving current and a predetermined temperature; and

said means for controlling controls said temperature regulating unit such that the temperature detected by said temperature measuring element substantially equals the predetermined temperature corresponding to the detected driving current as defined by said control function.

15. (Currently Amended) The semiconductor laser device according to Claim ~~1~~ 13, wherein said means for controlling controls said temperature regulating unit to extract heat from said semiconductor laser element as the detected driving current increases in accordance with said control function.

16. (Canceled)

17. (Canceled)

18. (Original) The semiconductor laser device according to Claim 13, wherein:

said semiconductor laser element includes an active layer; and

said control function is defined such that a temperature of said active layer remains substantially constant for varying driving currents.

19. (Original) The semiconductor laser device according to Claim 13, wherein said

means for controlling includes a means for storing said control function.

20. (Original) The semiconductor laser device according to Claim 13, wherein:

said means for controlling further comprises a means for setting a desired wavelength, and a means for storing plural control functions;

said means for controlling is configured to select a new control function from said plural control functions that corresponds to a desired wavelength entered into said means for setting; and

said means for controlling is configured to control said temperature regulating unit according to said new control function.

21. (Original) The semiconductor laser device according to Claim 13, wherein said control function is common to semiconductor laser devices having similar structure and operation.

22. (Original) The semiconductor laser device according to Claim 13, wherein said control function is defined by plural temperatures detected by said temperature measuring element and corresponding driving currents detected by said current detecting unit where a substantially constant wavelength output from said semiconductor laser element is maintained.

23. (Original) The semiconductor laser device according to Claim 13, wherein said control function is a linear function of predetermined temperature versus predetermined driving current.

24. (Original) The semiconductor laser device according to Claim 13, wherein said control function is a quadratic function of predetermined temperature versus predetermined driving current.

25. (Original) The semiconductor laser device according to Claim 13, wherein said temperature regulating unit is a Peltier device and said temperature measuring device is a thermistor.

26. (Currently Amended) A drive control method for a semiconductor laser device, the method comprising the steps of:

determining a control function defined as a relationship between a predetermined driving current and a predetermined temperature to achieve a substantially constant wavelength output from a semiconductor laser element of the semiconductor laser device;

detecting a driving current applied to the semiconductor laser element; and

controlling a temperature regulating unit such that a temperature of the semiconductor laser element detected by a temperature measuring element substantially equals the predetermined temperature corresponding to the detected driving current as defined by the control function,

wherein the semiconductor laser element and the temperature measuring element are thermally connected to the temperature regulating unit, and

wherein the semiconductor laser element includes a diffraction grating ~~and is configured~~ to oscillate plural longitudinal modes.

27. (Original) The method according to Claim 26, wherein the step of determining the control function includes the steps of:

detecting plural temperatures using the temperature measuring element and detecting corresponding driving currents where a substantially constant wavelength output from the semiconductor laser element is maintained; and

fitting a curve using the detected plural temperatures and corresponding drive

currents.

28. (Original) The method according to Claim 26, wherein the step of controlling the temperature regulating unit includes controlling the temperature regulating unit to extract heat from the semiconductor laser element as the detected driving current increases in accordance with the control function.

29. (Canceled)

30. (Original) The method according to Claim 26, further comprising the step of storing the control function within a storage unit.

31. (Original) The method according to Claim 26, further comprising the steps of:

storing plural control functions corresponding to different constant wavelengths;

setting a desired constant wavelength;

selecting a new control function from the plural control functions that corresponds to the desired constant wavelength; and

controlling the temperature regulating unit according to the new control function.

32. (Original) The method according to Claim 26, wherein the control function is a linear function of predetermined temperature versus predetermined driving current.

33. (Original) The method according to Claim 26, wherein the control function is a quadratic function of predetermined temperature versus predetermined driving current.

34. (Currently Amended) A drive control method for a semiconductor laser device for controlling a temperature of a semiconductor laser element on a basis of a temperature of the semiconductor laser element detected by a temperature measuring element disposed near the semiconductor laser element thereby controlling a wavelength of a laser beam oscillated by the semiconductor laser element, wherein the semiconductor laser element includes a

diffraction grating ~~and is configured~~ to oscillate plural longitudinal modes, the method comprising the steps of:

detecting a driving current applied to the semiconductor laser element;

acquiring a relationship between driving current and temperature at which the wavelength of the laser beam oscillated by the semiconductor laser element is generally constant; and

controlling the temperature of the semiconductor laser element so that the detected temperature of the semiconductor laser element and the corresponding detected driving current satisfy the acquired relationship.

35. (Original) The method according to Claim 34, wherein the relationship is a relationship between the driving current and the temperature of the semiconductor laser element at which a temperature of an active layer the semiconductor laser element is generally constant.

36. (Currently Amended) A drive control method for a semiconductor laser device for controlling a temperature of a semiconductor laser element on a basis of a temperature of the semiconductor laser element detected by a temperature measuring element disposed near the semiconductor laser element thereby controlling a wavelength of a laser beam oscillated by the semiconductor laser element, wherein the semiconductor laser element includes a diffraction grating ~~and is configured~~ to oscillate plural longitudinal modes, the method comprising the steps of:

detecting a driving current applied to the semiconductor laser element;

acquiring a plurality of relationships between driving current and temperature in which the wavelength of the laser beam oscillated by the semiconductor laser element is

generally constant;

setting a desired wavelength;

changing from a present relationship to a new relationship corresponding to the desired wavelength; and

controlling a temperature of the semiconductor laser element so that the detected temperature and the corresponding detected driving current satisfy the new relationship.

37. (New) A semiconductor laser device comprising:

a semiconductor laser element;

a temperature measuring element to measure a temperature of said semiconductor laser element;

a mounting structure having a first portion thermally connected to said semiconductor laser element, said mounting structure having a second portion thermally connected to said temperature measuring element, whereby said temperature measuring element indirectly measures a temperature of said semiconductor laser element via heat transfer through said mounting structure;

a temperature regulating unit thermally connected to said mounting structure;

a current detecting unit to detect a driving current applied to said semiconductor laser element; and

a control unit to control said temperature regulating unit by a control function to achieve a substantially constant wavelength output from said semiconductor laser element, said control function defining a relationship between a predetermined driving current and a predetermined temperature, said control unit being electrically connected to said temperature measuring element, said temperature regulating unit, and said current detecting unit to control

said temperature regulating unit such that the temperature detected by said temperature measuring element substantially equals the predetermined temperature corresponding to the detected driving current as defined by said control function.

38. (New) A semiconductor laser device comprising:

a semiconductor laser element;

a temperature measuring element to measure a temperature of said semiconductor laser element;

a mounting structure having a first portion thermally connected to said semiconductor laser element, said mounting structure having a second portion thermally connected to said temperature measuring element, whereby said temperature measuring element indirectly measures a temperature of said semiconductor laser element via heat transfer through said mounting structure;

a temperature regulating unit thermally connected to said mounting structure;

a means for detecting a driving current applied to said semiconductor laser element; and

a means for controlling said temperature regulating unit using a control function to achieve a substantially constant wavelength output from said semiconductor laser element,

wherein said means for controlling is electrically connected to said temperature measuring element, said temperature regulating unit, and said means for detecting.

39. (New) A drive control method for a semiconductor laser device, the method comprising the steps of:

determining a control function defined as a relationship between a predetermined driving current and a predetermined temperature to achieve a substantially constant

wavelength output from a semiconductor laser element of the semiconductor laser device;

detecting a driving current applied to the semiconductor laser element; and

controlling a temperature regulating unit such that a temperature of the semiconductor laser element detected by a temperature measuring element substantially equals the predetermined temperature corresponding to the detected driving current as defined by the control function,

wherein the semiconductor laser element is thermally connected to a first portion of a mounting structure and the temperature measuring element is thermally connected to a second portion of the mounting structure, and wherein the temperature regulating unit is thermally connected to the mounting structure, whereby the temperature measuring element indirectly measures the temperature of the semiconductor laser element via heat transfer through the mounting structure.

40. (New) A drive control method for a semiconductor laser device for controlling a temperature of a semiconductor laser element on a basis of a temperature of the semiconductor laser element indirectly detected by a temperature measuring element disposed near the semiconductor laser element via heat transfer through a mounting structure thermally connected to both the semiconductor laser element and the temperature measuring element thereby controlling a wavelength of a laser beam oscillated by the semiconductor laser element, the method comprising the steps of:

detecting a driving current applied to the semiconductor laser element;

acquiring a relationship between driving current and temperature at which the wavelength of the laser beam oscillated by the semiconductor laser element is generally constant; and

controlling the temperature of the semiconductor laser element so that the detected temperature of the semiconductor laser element and the corresponding detected driving current satisfy the acquired relationship.

41. (New) A drive control method for a semiconductor laser device for controlling a temperature of a semiconductor laser element on a basis of a temperature of the semiconductor laser element indirectly detected by a temperature measuring element disposed near the semiconductor laser element via heat transfer through a mounting structure thermally connected to both the semiconductor laser element and the temperature measuring element thereby controlling a wavelength of a laser beam oscillated by the semiconductor laser element, the method comprising the steps of:

detecting a driving current applied to the semiconductor laser element;

acquiring a plurality of relationships between driving current and temperature in which the wavelength of the laser beam oscillated by the semiconductor laser element is generally constant;

setting a desired wavelength;

changing from a present relationship to a new relationship corresponding to the desired wavelength; and

controlling a temperature of the semiconductor laser element so that the detected temperature and the corresponding detected driving current satisfy the new relationship.